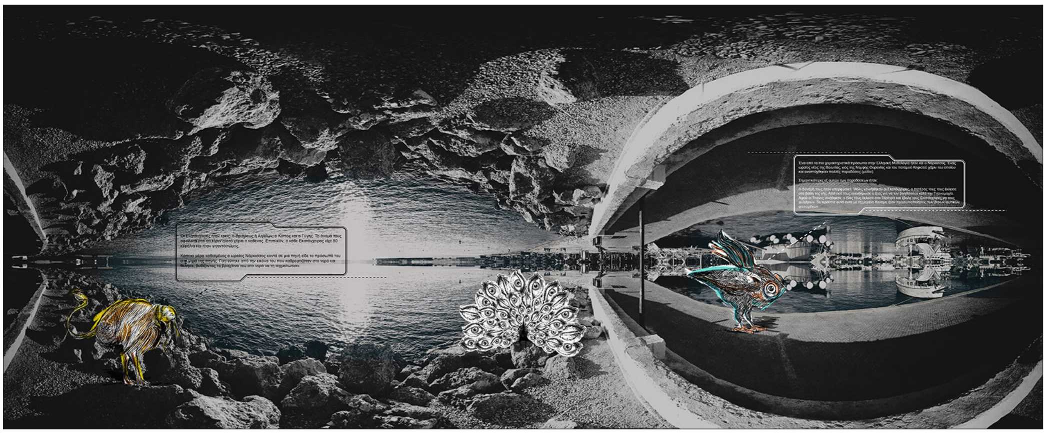
# Designing VR and AR gamifications for cultural heritage educational escape games

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*Abstract*

The paper attempts to address the way augmented reality (AR) technologies for mobile devices and virtual reality (VR) techniques for head mounted devices can contribute to culture, tourism and education by designing and developing an innovative infrastructure for digital escape games offering gamified experiences on site-related literary texts. The research presented is based on work carried as part of "Escape through Culture", a joint EU and Greek Research Foundation funded project that advocates the combination of Greek cultural heritage, digital technological advancements and the implementation of innovative gamifying practices.
Paper focuses on the process followed in amalgamating literary texts to synthetic 3D space, gamification and AR creating a hybrid set of escape games. The project is implemented in three distinct application levels; Desktop Mode (DeskMode Web - VR), Generic Augmented Reality Function (AR Generic) and the in-situ Augmented Reality Function (AR in-situ). Aim of the paper is to demonstrate the design perspective of the methodology followed in this integration leading to gamification.

*Keywords*
Escape games, Virtual Reality, Augmented Reality, gamification, cultural heritage



Demo splash screen of the application.



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## Introduction

"Escape through Culture" aims to design and implement hybrid digital environments that include elements of both games and literature and combine the ludic and the literary aspects as part of an innovative educational process. The process is carried out in three distinct approaches/levels:

A. The Desktop Mode (Web - VR) where the user experiences virtual tours in real or imaginary landscapes via "escape rooms" implemented as interactive 360-degree panoramas. The desktop mode of the game offers access to a variety of information through puzzles and multimedia resources.

B. The Generic Augmented Reality Function (AR Generic) where the user benefits from the adjustability of the use. Augmented Reality is called upon to co-operate with the literature, to complement and enrich the in-situ experience and to stimulate the symbolic and mental perception of the landscape.

C. The in-situ Augmented Reality Function (AR *in-situ*) where gamification is provided through a networked mobile device in physical space. Users who choose to play the game in-situ are in direct interaction with the landscape, experiencing and approaching it multisensorially (i.e. sounds, smells, touch), forming their own personal or idiosyncratic reading based on their sense of place. The user is free to choose the elements which, as cultural manifestations, form the current landscape that they can experience through the game.

These versions employ narrative, dramatic and poetic elements which are combined with puzzles and the game logic of an escape game to provide educational affordances to the aforementioned ludic structures and processes. The final hybrid digital object is presented as a new form of educational practice that offers novel ways of playing while reading notable texts of Greek authors and poets. During the recent COVID-19 pandemic, the development of escape rooms moved into the digital realm leading to a significant increase of digital escape games [Ambrozová et al. 2021; Makri et al. 2021] played by one or more players, either exclusively digitally or sometimes in a mixed design mode that combine solving both digital and physical puzzles. Most are based on a narrative, whereas others include non-plot-based challenges and puzzles. Usually, the space in digital escape games is not built in 3D, except when they utilize AR / VR hardware. While researching the topic, few relating projects where identified, with the two worth mentioning being *Athens Escape Route* and *Museum Escape*. The former is an online puzzle solving and virtual tour game on Athens and its culture, designed exclusively for the Municipality of Athens and the Athens Culture Net. Museum Escape, is a Horizon 2020 funded project, utilizing part of the Archaeological Museum of Tripoli collection, aiming at a higher engagement of visitors and their interaction with museum collections. By and large, research focused on educational escape games employs no particular methodology. However, regarding research focusing on tourism and entertainment, emphasis is placed on the use of augmented and virtual reality technologies that may attract the interest of players [Kazak et al. 2020] while the content of escape room stories and riddles presents a huge range and flexibility [Conzen 2001].

## Methodology / Gamification

The inherent qualities of the "Escape through Culture" project indicate the adoption of escape environments - "escape rooms" as the main design framework. These "escape" environments refer to places of interest, both touristic and cultural, and are grouped thematically, spatially and cartographically in order to urge the player/user to "unlock" the narrative sequences of the game. They consist of gamified structured entities which allow and encourage interaction with the player by combining two basic elements: the wandering through landscapes which are enriched by and via textual narration and puzzles which unlock contemporary images, sounds and memories of the landscape. The interaction is achieved concurrently: on one hand through the exploration of places and literary texts and on the other hand through the puzzles that the player is required to solve to escape from each place and transfer to the next one.




Fig. 01. Screen capture of the interactive interface (360° image). Image by the authors.

According to Scott Nicholson [2015], the notion of meaningful gamification is strongly related to the endogenous motivations of the gamification process, but without ignoring the benefits of the exogenous ones. During the comprehension of the specific features of the project, the Self Determination Theory of Deci and Ryan [2004] is of particular importance as it is based on the concurrent creation and preservation of different types of motivations. Exogenous and endogenous incentives are combined with subjective behavioral approaches as advocated by both the theory of behaviorism [Ertmer, Newby 1993] and the cognitive theories (cognitivism) [Patrick, Williams 2012]. The design process of gamified environments focuses on 3 main compositional elements: spaces, puzzles and texts. These concepts can be represented as sets of various elements that can be placed on a Venn diagram (fig. 01). The combination of these elements creates a dominant, broader narrative and the overall experience of the "Escape through Culture" project, while providing a new motive for reading, understanding and cognitive imprinting of the texts and landscapes by using temporary digital means of information representation and various gamified entities. The gamified entities of the project come out of the combination of these design elements. The characters and the goals are emerging from the texts, the places are the landscapes of action and the puzzles are designed by incorporating various educational and playful characteristics that are detected in the aforementioned literature.

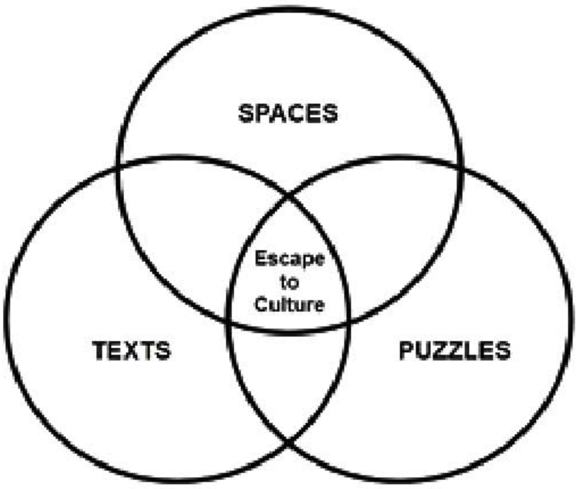



Fig. 02. Conceptual Venn diagram of the 3 main design elements. Image by the authors.

## Puzzles

A fundamental element of escape games are puzzles. During the game, an intense and continuous dialogue between space and literature evolves, which ignores time references and through technology, combines the various meanings and binds them with a series of puzzles that must be solved. The goal is to escape from the incarceration area in the shortest possible time, solving puzzles and, in a broader sense, fulfilling missions.

Puzzles implemented in "Escape through Culture" are classified in three main categories:

- Puzzles that require knowledge and thought.
- Puzzles that require searching and placement of objects to certain points of interest.
- Meta-puzzles that require the solving of others puzzles to complete.

The abovementioned categories are structured in three basic (open, sequential and path based) and one hybrid (pyramid) format [Nicholson 2016].

## Space in the game

One of the main characteristics of an escape game is space itself. In "Escape through culture", space and thus time, is charged with multiple meanings. The space in which the player acts is crucial for the final experience of the game and is thus classified as:

• The present, temporary space-landscape (now).
• The space-landscape at the time reference of the text (then).
• The current space-landscape of the player ("in situ" player space, indoor or outdoor).
• The digital space as it is experienced through the virtual visit of the player.
• The overall space-landscape as it is transformed and enhanced with the addition of the mixed reality (VR and AR) layer.

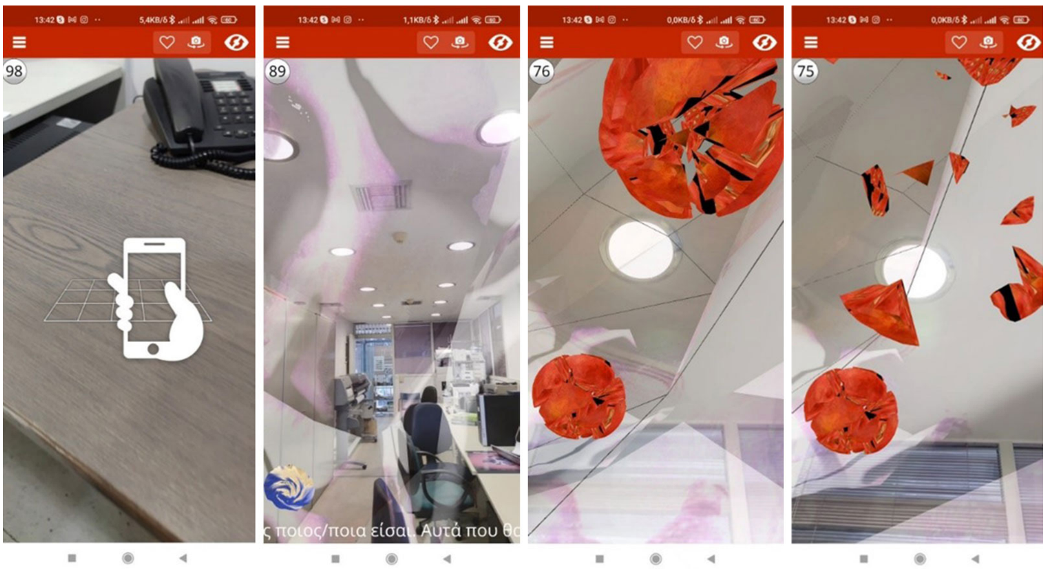



Fig. 03. Screen shots from the AR Generic level (interactive 3D content demo). Image by the authors.

The "in situ" experience, integrates onto the landscape elements of the literary approach that are absent from the present time due to the spatial transformations, the restructuring of the social, political and economic conditions, or any other cyclical changes in time (seasons, weather conditions, time of day etc). Experiencing the game in another physical indoor or outdoor space, audiovisual augmented reality enhancements are used to supplement and enrich the literary elements, to stimulate the symbolic and mental perception of the landscape and thus improve the overall spatial experience.

In this case, the user's "sense of place", is basically formed by the literary description of the author, followed by the superposition of the digital elements and the mental projections of the player's own cultural context.
Finally, when the game is played in the catholic virtual space, there is no "on-site" experience - the physical presence of the authentic landscape is lost. In this version the 360° images that represent the landscape can immerse the player into the interactive 3D environment of the virtual world, experiencing a subjective sense of presence [Eichenberg 2011; Papasarantou et al. 2012] and the ability to navigate and interact with any digital objects and puzzles encountered.



Fig. 04. 360° image for the Desktop mode (Web - VR). Image by the authors.

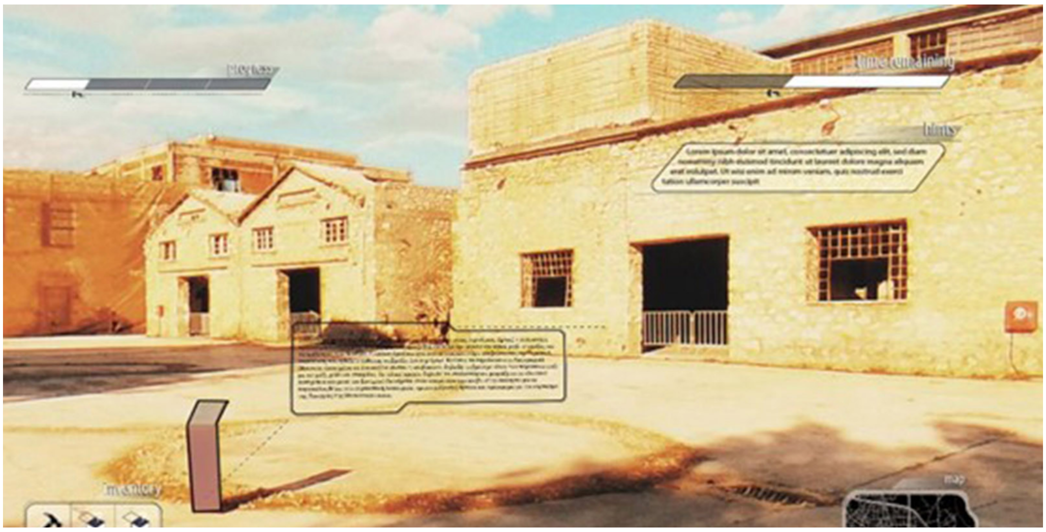


Fig. 05. Screen capture of the interactive interface (Desktop Mode, 360° image). Image by the authors.

## Literature in the game

Meyer [2017] argues that "In the modern age, literature is ubiquitous. And so are video games. Video games, like literature, have narrative. They have conflict, and tension, dialogue and characters". According to this statement we can also argue that literature and video games share common connections.

They are cultural expressions capable of developing narratives which not only unfold by the inherent properties of the medium but also through the idiosyncratic lens of the player/reader. Thus, forming an alternate/hybrid reality that occupies a new time-space which originates from the dominant narration but at the same time allows the development of new actions, reactions and thoughts that would not manifest without the exposure to the medium. The reader and the gamer become travelers in the places of the narration and experience all the cultural and ideological elements that the creator provides.

### Educational aspects

In recent years, many efforts have been made to modernize and enhance the pedagogical processes in all levels of education. Many researchers support that active participation enhances learning, through practicing and discussing about a subject [Chickering, Schlossberg 2002; Kolb 2014]. This type of experiential learning is also present in any type of game that aims to teach during gameplay [Smith, Pellegrini 2008; Roussou 2004; Zosh et al. 2017]. Many of the necessary skills developing during play, can be gained by participating in escape games that are based on an educational theme and are designed exclusively for each content and according to the learning objectives [Reuter et al. 2020]. Educational escape games can be designed for any level of education and support the pedagogical process by incorporating gamified elements to any learning procedure. Furthermore, during the new millennium, the research field of gamification is expanding to areas of interest that include the escape game genre and the amount of literature on this topic is growing every year [Makri et al. 2021; Tercanli et al. 2021]. The educational aspects of "Escape through Culture" can easily emerge from the combination of the basic design elements (texts, places and puzzles) that allow the introduction of many educational aspects to the main gameplay of an escape game. This type of design also allows through the variety of content, the adaptation of the game to many teaching areas such as literature, culture, geography, history, natural sciences/mathematics and others [Papadopoulos et al. 2016].

### The user's involvement in the game

The user's involvement in the game can have social, cognitive and emotional aspects. Social involvement is related to the player's presence in the game and can be direct (the player participates with a physical body in the action of the game) or indirect (the player travels mentally and acts in the virtual space).




Fig. 06. Screen shot from the VR demo (Desktop Mode, 360° image). Image by the authors.

Regardless the type of presence, the player interacts with the cultural landscape (either physical or virtual) but also with other people. The cognitive involvement satisfies the players curiosity but also the need to familiarize with the cultural elements, to explore and discover their relationship with literature. Cultural exploration can be considered one of the basic motives for tourism as it includes "the practice of traveling to experience historic and cultural attractions, to learn about a community's heritage in an enjoyable and educational way" [Lord 1999]. Cognitive involvement also involves the need to combine clues that are included in a poem or in a literary text, to solve the game's puzzles. Emotional involvement can sometimes be related to the various bonuses that are given as rewards but also with the emotions that are generated due to the participation in the game itself - anticipation and suspense, persistence and dilemma, solution and joy or even allurement caused by the texts, images or soundscapes.

## Conclusions

"Escape through Culture" promotes the logical, critical thinking and problem-solving skills of the participants, motivating them to communicate and collaborate (both digitally and physically) while learning about the overall cultural heritage of Greece thus creating an interactive framework for the creation of digital escape games. What is offered during the play of the game is a cultural experience that emerges through the involvement with the language, the linguistic and spatial symbols that are used in the literature, the virtual or physical tours, the contact with the objects that are included in the spaces, the nostalgia of the past and the desire for visitors to experience new, alternative cultural forms and landscapes. The resulting experiences can be characterized as unique and original, particularly educative and entertaining. Furthermore, they facilitate the interest of participants and their engagement to future explorations.


#### Credits

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